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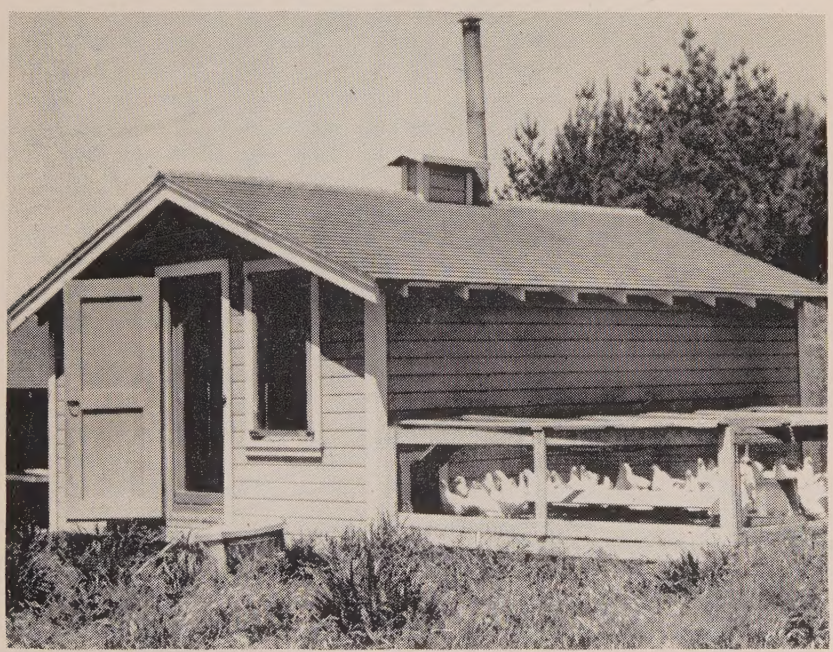
Brooding and Pullet Development

C. E. LAMPMAN, PREN MOORE, C. F. PETERSEN, K. R. FROST



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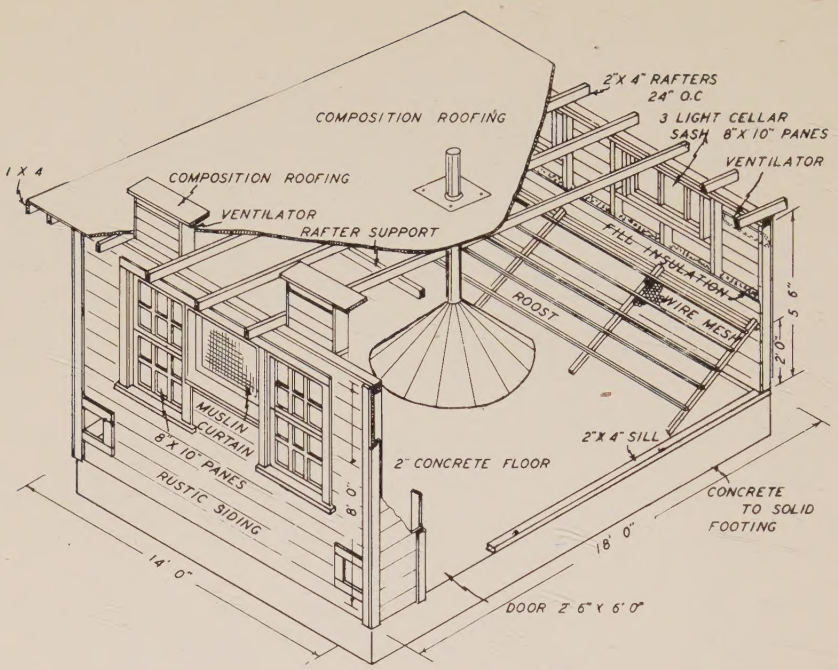

Figure 1.—Shed roof type brooder house with concrete floor and foundation. Note double sash windows in front, ventilators at front and rear plates, and door in the southeast corner.

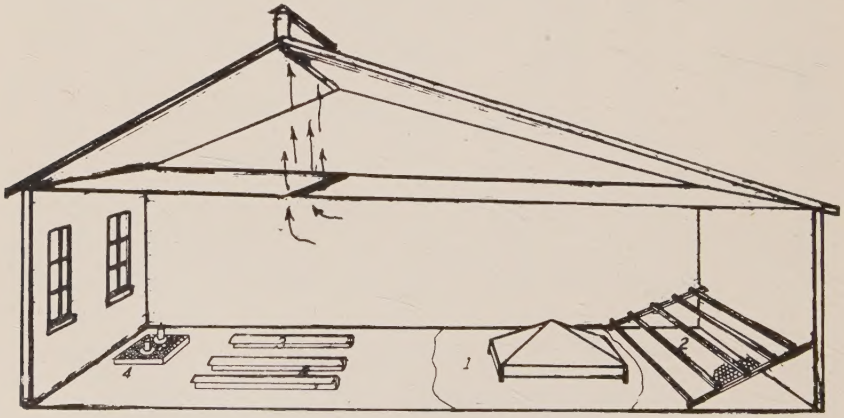

Figure 2.—General perspective showing adequate floor space for chicks and equipment. 1—temporary corral for the first 2 days, 2—slanting roosting frame, 3—mash feeders, 4—covered water founts on wire platform.

Brooding and Pullet Development

C. E. Lampman, Pren Moore
C. F. Petersen, and K. R. Frost*

BROODING and rearing the young stock constitutes one of the most important phases in the poultry enterprise, yet it is often the one least efficiently done. Too many pullets are raised in overcrowded, poorly ventilated quarters, and on contaminated ground.

Good housing and management, including systematic sanitation, balanced rations, and good feeding practices, are all involved in the job of producing well-developed disease-free pullets; only good pullets can be considered a profitable investment.

The Brooder House

The brooder house should provide suitable quarters for the growing chicks and fit the program of sanitation and disease control. The principle required in efficient brooding is comfort for the chick. To be comfortable the chick must have access to varying degrees of temperature. The brooder house must provide sufficient floor space, and the brooder so located that the chicks may go to and from the heat at will. There must also be space for slanting roosts in the back and for feeders in front of the brooder *(See Fig. 2)*.

One-half square foot of floor space per chick for straight-run and about twice that for sexed pullet chicks is recommended. As an example, 500 straight-run chicks need about 250 square feet of floor space. A brooder house 14 x 18 provides excellent accommodation for that sized unit. Small units will obviously require more floor space per chick in order to provide the accommodations emphasized above.

Type. The shed roof is generally recommended. When equipped with the outlets at the front plate, as illustrated in Figure 1, for ventilation and moisture control, it is particularly adapted for cold and windy weather. During such periods the windows can be kept closed, and the exchange of air by infiltration will be sufficient to provide fresh air without cold floor drafts. The combination or gable roof types, if equipped with suitable outlets and constructed with a minimum of overhead space, will be equally satisfactory.

Size and Insulation. Both will be influenced by the program of sanitation. The use of the permanently located house with the sanitary sunyard has become prevalent in recent years and is recommended for the larger and more specialized enterprises. Such a house should be built with a concrete foundation and floor, with walls and ceiling double-boarded and insulated. The greater the depth from front to rear wall, up to 20 feet, the more satisfactory it will be.

If the concrete foundation is not used it is a good plan to build the house on skids and limit the size to that which can be moved. The 14 x 18 size could be considered semi-portable, and it could be moved in case of

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necessity. If the house is to be considered portable in the sense that it will be moved from year to year, the size and weight will necessarily need to be limited. For greater detail on poultry house construction and ventilation, see Extension Bulletin 147, *Housing Farm Poultry.*

Producing healthy disease-free pullets is one of the limiting factors in a successful poultry enterprise. Following are some of the major practices which a reasonable sanitary brooding program should include:

1. Raise the young chicks entirely separate from the old stock, or the quarters and ground used for old stock.

2. Have the brooder house and equipment thoroughly cleaned and disinfected before the chicks arrive.

3. Avoid contaminated ground. Rotate the fields used for brooding and rearing. If the house is permanently located, use wire-bottomed or concrete sunyards, and move the pullets to a clean range as soon as age and weather conditions permit.

4. Avoid tracking contamination from old stock to young chicks. This is especially important in controlling coccidiosis.

5. Dryness inside the house and out is important in controlling disease and parasitic infestations—particularly coccidiosis. Elevate the drinking fountains on wire platforms and move outside as early as possible.

6. Use waste-proof mash hoppers to prevent mash from spilling over in the litter.

7. Avoid overcrowding as a disease-control measure.

Sanitary sunyards are usually located on the south side and this is necessary in the case of a long building with numerous pens. An alternative for the individual units is to locate the yard on the east side. With this arrangement the chicks have access to the sun in the forenoon and the shade in the afternoon. Both arrangements are used at the University Poultry Farm and the latter is preferred, particularly for late season brooding. Yards located on the south side usually need to be provided with some shade as the brooding season advances.

If the floor of the yard is of concrete it should be given a slight slope away from the house. The wire-bottomed floor should be built in sections, using ½- or ¾-inch mesh wire on panels made of 1 x 4 or 1 x 6 material used edgewise. The size of the yard should nearly equal that of the floor space in the brooder house; the width should not be less than 8 to 10 feet. The ground underneath the wire yard should be treated with used crankcase oil or chlorates to prevent the vegetation from growing up where the chicks might reach it. For more detailed information on sanitation see Extension Bulletin 142, *Prevention and Control of Poultry Diseases.*

Brooders

Whatever the type or style, a good brooder of standard make constitutes the best investment; use a large enough size to do a proper job of providing uniform heat. Observe reasonable safeguards against fire hazards.

Oil Brooders. New and improved fuel oil brooders have been developed to the extent that they are very satisfactory and one of the most popular types. When properly operated and regulated they maintain a

uniform temperature. This type has the advantage of providing more room heat, which promotes a drier condition for early season brooding. Late in the season the heat may be turned off during the day and started again late in the afternoon.

Electric Brooders. The use of electric brooders has become more widespread with the improvements in the brooders themselves, and the use of better built houses. The forced air circulation in the newer types helps to keep the litter dry under the hover. About 7 square inches of space under the brooder should be allowed per chick. Very little room heat is created by electric brooders, so that the house should be tightly constructed and properly insulated and ventilated. Some of the advantages of the electric brooders include less routine in operation, less fire hazard, cool room temperature, and the possibility of turning off the heat during the middle of warm days late in the season. Commercially manufactured electric units, including the heating element, wiring, and thermostat control, are obtainable to incorporate in homemade hovers when that is preferred.

The iron wire heating elements, which have come into use during the war emergency period, should be considered temporary equipment. The iron wire rusts and may burn out after one season's use.

Wood-burning Brooders. This equipment may be preferred by some in areas where wood is plentiful and cheap. The wood-burning type can be obtained from several manufacturers. The underground furnace and flue system has been used extensively in Idaho. Plans for this system may be obtained from the Department of Agricultural Engineering, University of Idaho.

Brooding Practices

Regardless of the system the aim is to provide uniform dependable temperature under the hover and to allow sufficient area away from the edge of the brooder to permit the chicks to select their own degree of comfort.

Chicks Need to be Hover Broken at the Start. It is essential to teach the chicks the source of heat whether they are a day-old or battery started. This may be accomplished by the use of a corral—such as a 12-inch board, a strip of galvanized iron, or by the use of inch-mesh wire netting 2 feet high. The enclosure should be enlarged after the second day and by the third or fourth day the chicks should have the run of the whole house. A solid floor guard, either wood or metal, about 15 inches high, placed in front of the brooder is helpful in preventing floor drafts when windows or doors are opened. Such a guard may be moved up close to the edge of the brooder during the day to conserve fuel as well as prevent cold floor drafts; it is moved farther away or taken out entirely at night.

Chicks are Sensitive to Temperature. Chicks do remarkably well in seeking their own comfort if they are properly hover-broken at the start and when the right conditions of heat are supplied. Although the behavior of the chicks is the real test of correct temperature, a thermometer may help in routine checking; at the start about 95 degrees, 2 to 3 inches above the floor at the edge of the canopy of oil brooders or under center of electric brooders should be about right. After the first week the temperature is gradually reduced. Insufficient heat causes the chicks

to crowd, either against the brooder or in corners; those at the bottom often smother. Chilling may result in the development of digestive disorders. Too much heat drives the chicks away from the brooder and causes them to be restless. An overheated house quickly devitalizes the chicks, causes the air to be too dry, and aggravates cannibalism.

The room temperature should be cool enough for the chicks to appreciate the brooder as the source of heat. This is particularly important before dusk when the chicks begin to settle for the night.

Encourage Early Roosting. This is best accomplished by the use of roosting frames. These frames are covered with 1-inch mesh wire netting and they are placed on a slant from the floor at the rear of the brooder to a height of from 1½ to 2 feet on the rear wall.

Direct Sunlight is Beneficial for Early Chicks. Inasmuch as the ultraviolet rays of direct sunshine do not pass through ordinary window glass, these health-promoting rays should be admitted through window and door openings. The double-sash windows, illustrated in Figure 1, are arranged with the upper and lower sash hinged at the middle; the entire window is held in place with buttons or clamps so that it can be easily removed. Such an arrangement permits the windows to be opened to whatever extent the weather permits on warm sunny days. Encourage the chicks out-of-doors at an early age; feed troughs placed just outside the door will help attract them out. The chick door should not be too large, otherwise too much cold air will drift in over the floor.

Conserve Feed Values with Covered Feeders. Sunshine rapidly destroys the vitamins and causes a general deterioration in the value of the feed. Covered feeders, such as illustrated in Figure 4, will pay big dividends in conserving the quality of the mash.

Remove Cockerels Early. Chicks soon outgrow their quarters; the removal of cockerels relieves the congestion and make possible a more uniform development of the pullets. Cockerels are ordinarily sold as broilers when they average around 2 pounds, but it is desirable to remove them before this age even though they need to be held temporarily in some less desirable building.

Prevent Cannibalism

Cannibalism is likely to develop when young chicks are allowed to become restless under congested conditions. Overcrowding, the confinement of chicks too close to the brooder house, overheated brooder houses, lack of green feed, and irregular feeding practices are some of the more common causes. The trouble starts accidentally in most cases during the stage when the tail and wing feathers are soft and filled with blood at the base; after blood is once drawn, the trouble spreads very rapidly. Measures of prevention should be practiced so far as possible.

Chicks should be fed outside in the yard as early as the weather will permit and continuously thereafter. Cockerels should be removed as previously outlined. Alfalfa leaves should be provided in wall feeders from the beginning and cut green feed should be fed in the yards as soon as it is available. The chicks should not be allowed to become excessively hungry or confined inside the house after they are accustomed to run outside. All practices that will encourage the chicks outside and that will

keep them contented and busy are worthwhile safeguards against this trouble. It is one of the most difficult vices to control after it has once started and the habit is likely to be carried over after the pullets are put in the laying house.

If the trouble breaks out the picked birds should be removed at once and treated with some "no-pick" preparation. Several commercial products are available which are quite satisfactory. In the absence of a better remedy cup grease containing a small portion of sheep dip will serve quite effectively as a repellent.

Feeding

Basic Requirements. The growing chick has high requirements for proteins, vitamins, and minerals. Fresh-growing succulent green feed contains many of the essential nutritional factors. Direct sunshine and milk or milk products help materially in promoting normal nutrition.

When chicks are hatched early and reared in confinement for the first several weeks, these essential nutritional factors must be incorporated in adequate amounts in the starter mash. Well-balanced rations offer the best assurance for normal orderly growth and the prevention of nutritional deficiency diseases.

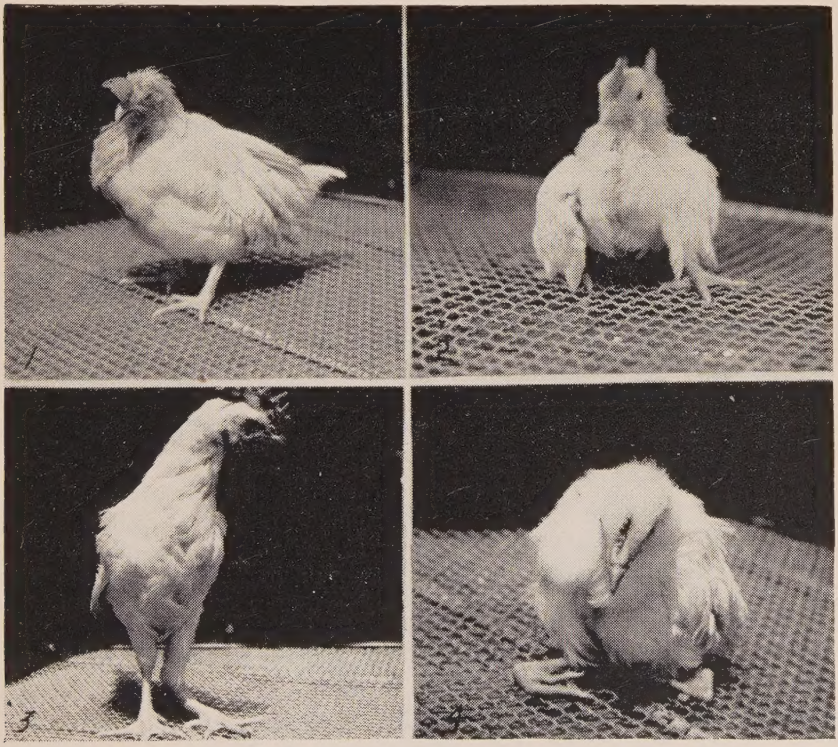


Figure 3.—Common nutritional deficiency diseases in growing chicks. 1—Vitamin A deficiency, 2—Rickets due to lack of Vitamin D, 3—Perosis or slipped tendons, 4—Curled-toe paralysis due to lack of riboflavin.

Proteins. The protein requirements of growing chicks are correlated with age and rate of growth. Both the quality and quantity of protein is of great importance during the first few weeks. The chick-starter mash should contain 18 to 18½ percent protein, the exact level depending upon the source and quality of protein. It is desirable to use a combination of protein concentrates, including at least three or all of the following: fish meal, meat meal, dried milk, and soybean oil meal. Recent experiments prove the proteins of fish meal and milk rank high in efficiency because they contain a more complete assortment of the essential amino acids.

The starter-mash is used without supplementary grain for about the first 2 weeks. At that time some grain, such as whole wheat, should be introduced and gradually increased. The protein content of the total feed intake is proportionately reduced as the supplementary grain is increased. At 8 weeks of age the chicks are usually shifted to the developing mash, which contains slightly less protein.

The proteins of liquid skimmilk are efficiently utilized by the growing chick. When used as the sole drink for the chicks for the first few weeks, no supplementary protein need be included in the mash. (See Formula No. 7, page 11, and explanatory footnote.)

Vitamins

There are numerous nutritional factors designated as vitamins, which are essential for normal growth. The three discussed below are those which are more likely to be deficient in the average practical ration made up of natural feed stuffs.

Vitamin A. A lack of this vitamin results in poor growth, reduced vitality, and increased susceptibility to infectious diseases. Symptoms typical of an advanced stage are illustrated in Figure 3, and consist of watery eyes, unsteady gait, ruffled feathers, poor growth, and pale shanks.

The important sources include succulent green forage, alfalfa meal of good quality, particularly dehydrated meal, yellow corn, and the fish oils.

Vitamin D promotes normal mineral assimilation by functioning as an activating agent in the utilization of calcium and phosphorus. The ultraviolet rays of direct sunshine constitute the natural source of the calcifying agency.

A deficiency of this vitamin results in a type of leg weakness known as rickets and in advanced cases the bird is unable to stand or walk normally *(See Fig. 3)*. The bones are soft and low in ash and the keels usually crooked due to poor calcification; growth is also retarded. In modern feeding practices for chicks raised indoors, vitamin D is supplied by the use of fish oils or one of the powdered concentrates. These products vary in vitamin D potency and should be incorporated according to the concentration. (See suggested chick mashes on page 11.)

Riboflavin (vitamin G) specifically influences growth and hatchability. Symptoms typical of an extreme case of deficiency in a growing chick (curled-toe paralysis) is illustrated in Figure 3. Other symptoms include slow growth, general unthriftiness and ruffled feathers; in poults

the deficiency causes scablike sores at the corner of the mouth and eyelids and on the bottoms of the feet.

The principal sources of riboflavin include fresh growing greens, good quality alfalfa meal, milk products, and numerous riboflavin concentrates.

Table 1.—Approximate average weight of White Leghorn and general purpose males and females[1] (in pounds for ages indicated)

Age (weeks)	White Leghorns		General purpose	
	Males	Females	Males	Females
0	0.09	0.09	0.09	0.09
2	0.22	0.20	0.22	0.22
4	0.50	0.47	0.50	0.42
6	0.88	0.80	1.10	0.85
8	1.25	1.13	1.75	1.33
10	1.95	1.50	2.25	1.75
12	2.32	1.85	2.85	2.30
16	3.16	2.44	4.10	3.00
20	4.00	3.10	5.00	3.85
24	4.60	3.75	5.75	4.80

[1]Data for White Leghorn pullets are from feeding experiments at the Idaho Agricultural Experiment Station. Other data were compiled from various sources including Jull, 1943, *Successful Poultry Management,* and Winter & Funk, 1941, *Poultry Science and Practice.*

Minerals

Salt, calcium, phosphorus, and manganese are the supplementary minerals which need consideration in formulating rations for growing chicks.

Fine granular salt, free from lumps, should be used at the rate of 0.5 percent of an all mash ration and 1 percent of a mash to be fed with grain. Salt plays an important role in nutrition, adds palatability to the ration, and a deficiency appears to aggravate cannibalism.

Calcium and phosphorus utilization is influenced by the adequacy of vitamin D and the ultraviolet rays of direct sunshine. These two minerals need to be incorporated in the proper amounts and in correct ratio to each other. For practical purposes the chick starter should contain 1.75 to 2.00 percent calcium and 0.7 to 1.00 percent phosphorus. The need for supplementary phosphorus depends upon the bone content of the meat meal and the extent to which vegetable proteins such as soybean oil meal are used. Meat meals, which average 50 to 55 percent protein, contain considerable bone and when used to the extent of 5 percent or more no additional bone meal is needed. When soybean oil meal is used extensively, bone meal may need to be added to the extent of 1.5 percent. The supply of bone meal has been very short during the war and deflourinated rock phosphate has become available as a substitute. The use of phosphorus supplements in the correct amount is best safeguarded by following a proved formula.

Perosis

An excess of minerals, particularly phosphorus, or a deficiency of manganese causes an enlargement of the hocks, commonly referred to as

"slipped tendons," and technically termed perosis *(See Fig. 3)*. Manganese is required in exceedingly small amounts; when bran and shorts are used extensively a deficiency is not likely. However, it is quite a common practice to add manganese sulphate to the starter mash at the rate of ¼ to ½ pound per ton (equivalent to ¼ to ⅓ *ounce* per 100 pounds). The vitamin "choline" is concerned in the prevention of perosis, but it is not likely to be deficient in well balanced practical rations which contain some animal protein concentrates.

Minor mineral elements such as iodine, iron, copper, potassium, and others are needed in minute quantities, but appear to be adequately supplied in the average practical mixture. Iodized stock salt is frequently used to safeguard against a possible iodine deficiency. In general, there is a greater likelihood for the need of supplementary iodine when calcite or limestone replaces oyster shell and when the legume proteins replace the fish meals.

Table 2.—Approximate feed requirements to obtain certain live weights with Leghorns and general purpose breeds

Average live weight	Kind and sex of chicken and pounds of feed required per bird			
	Leghorns		General purpose	
	Males	Females	Males	Females
1.0	3.0	3.2	2.5	2.9
1.5	4.9	5.4	4.2	4.7
2.0	7.2	8.0	6.0	7.2
2.5	10.0	11.5	8.0	10.0
3.0	13.3	16.0	10.2	13.0
3.5	18.0	23.0	12.5	16.5
4.0	25.0	.....	15.0	20.5
4.5	40.0	.....	19.0	24.0
5.0	.....	.....	23.0	29.5

Source of data includes: National Research Council, 1944, *Recommended Nutrient Allowances for Poultry*; Winter & Funk, 1941, *Poultry Science and Practice*; and the Idaho Agricultural Experiment Station.

Rate of Growth and Feed Consumption

Chicks grow at a rapid rate during the first few weeks. The average weights in Table 1 show that chicks approximately double their weight during each 2-week period for the first 6 weeks. The rate of growth varies with the breed, strain, completeness of the ration, and environmental conditions. The weights listed will serve as a guide for birds that are grown on range after the brooding period.

The data in Table 2 furnishes information on feed requirements for different body weights. By combining this information with that on growth in Table 1 the feed requirements at various ages may be estimated.

Table 3.—Suggested Chick Mashes
(Based on 100 lbs.)

Ingredient	Starter				Developer	
	No. 7	No. 8	E8	E9	No. 13	E11
Bran	16.0	18.0	18.0	18.0	20.0	20.0
Ground oats	15.0	12.0	10.0	12.0	15.0	15.0
Ground yellow corn	25.0	25.0	20.0	20.0	20.0	15.0
Ground wheat	10.0	9.5	7.0	6.0	7.0	13.0
Ground barley	9.0	.....	5.0	5.5	8.0	10.0
Shorts	10.0	10.0	10.0	7.0	8.0	.....
Dehydrated alfalfa meal	7.0	7.0	5.0	5.0	5.0	5.0
Fish meal (65-70% prot.)	.....	5.0	2.5	.....	4.0	.....
Meat meal (50-55% prot.)	.....	5.0	3.5	7.5	4.0	10.0
Soybean oil meal	.....	.....	10.0	12.0	.....	5.0
Dried milk (1)	.....	5.0	2.5	.....	4.0	.....
Dried whey (1)	.....	.....	2.5	3.0	.....	3.0
Oyster shell	4.0	3.0	2.5	2.5	3.0	3.0
Bone meal	3.0	.....	1.0	1.5	1.0	.....
Salt	1.0	0.5	0.7	0.5	1.0	1.0
Fish oil (2)	.....	.....	.....	.....	.....	.....
Manganese sulphate (3)	.....	.....	.....	.....	.....	.....
Average analysis (in percent)						
Protein	.....	17.80	18.20	18.20	17.00	17.00
Calcium	.....	1.90	1.80	1.80	2.10	2.20
Phosphorus	.....	0.86	0.88	0.84	0.95	0.90

(1) If milk products are not available, use one of the commercial riboflavin concentrates according to the manufacturer's instructions.

(2) Use fish oils according to potency—85D at 1 percent, or 20 pounds per ton; 400D at 0.25 percent, or 5 pounds per ton; 800D at 0.15 percent, or 3 to 3.5 pounds per ton.

(3) Manganese sulphate at the rate of ¼ to ½ pound per ton of starter mash is an added protection against perosis.

Explanation of Formulas in Table 3

Mash No. 7 is used with liquid skimmilk as the source of protein; give milk as the sole drink for the first 3 or 4 weeks.

Mash No. 8 is a complete starter mash, which has been used extensively with good results. It may be used as a basis for modification, for example:

(1) If slightly *higher protein* is desired, use 6 percent of fish meal and 5½ percent meat meal.

(2) If *soybean oil meal* is to be included, use 4 to 5 percent of each—fish meal, meat meal, soybean oil meal, and dried milk.

(3) For a *high protein broiler mash,* use 7 percent fish meal, 6 percent meat meal, 5 percent soybean oil meal, and 5 percent dried milk.

(4) For a *low protein developer mash,* use only 4 percent each of fish meal, meat meal, and dried milk.

E8 is a specific modification of No. 8, using less of the animal proteins and more soybean oil meal.

E9 and E11, containing neither fish meal nor dried milk, are suggested when shortages of these two items prevail.

Mash No. 13 is a developer mash with protein reduced to 17 percent.

The developing mash does not need to be as fully fortified with the vitamin concentrates when the birds are on range and have succulent green feed.

Dried whey may be used to replace dried milk as a source of riboflavin to the extent of 3 percent of the mash.

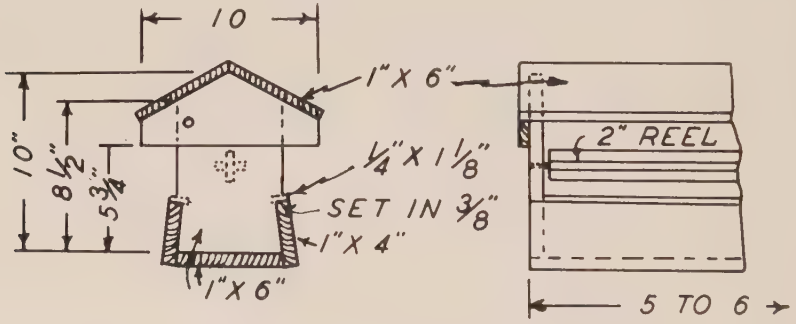
Oats and barley should be of good quality and finely ground.

Ground cull peas may be used at the rate of 10 to 15 percent in any of these mashes.

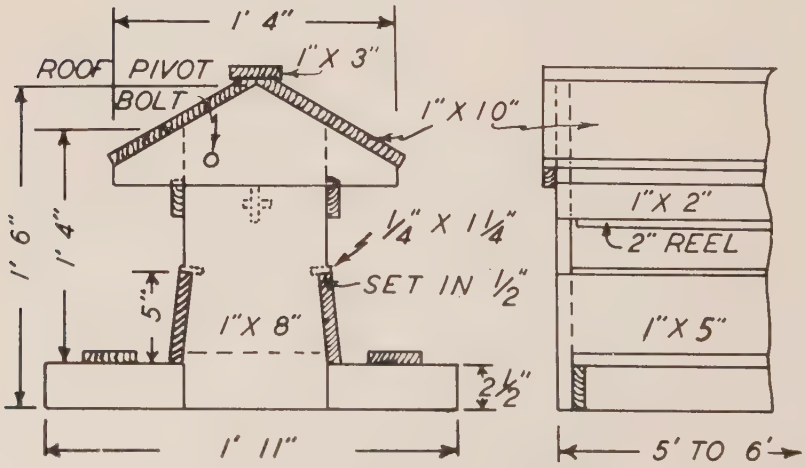
Feeding Practices

The First Feed. A good starting mash may be given any time after the chicks are 24 hours old. If shipped from any distance the chicks should have feed and water as soon as they arrive. The mash is provided continuously from the start—at first, in small lath troughs or flat boards edged with lath, so that it is readily accessible. After the chicks are older these are replaced with larger feeders, such as those illustrated in Figure 4. The latter are designed to prevent waste and contamination of the feed. It is important to provide sufficient feeders—a trough 4 feet long with feeding space on both sides for each 100 chicks is about right.

Introduce a grain mixture when the chicks are approximately 2 weeks old. It may be fed as an evening feed on top of the mash. The porportion of the grain is gradually increased until the ration is about equal parts of mash and grain by the time the birds are 12 weeks of age.



SMALL MASH FEEDER FOR YOUNG CHICKS



LARGE RANGE FEEDER

Figure 4.—Covered feeders to prevent deterioration from rain or sunshine. The smaller size will accommodate chicks after they are 2 weeks old.

Cracked yellow corn should be used to supplement whole wheat to the extent that price permits.

Hopper-feed whole oats after the birds are 6 to 8 weeks of age. It is a common practice to continue the hopper-feeding of whole oats through the growing perod and later in the laying house.

Leaves of bright green alfalfa hay, fed in self-feeders, are highly beneficial in supplying several essential elements for the early hatched chicks. Freshly cut green alfalfa, or other succulent green feed, should be provided as soon as it is available.

Avoid Premature Development. A "developer" mash with a lower protein, such as No. 13, should replace the starter when the birds are from 6 to 8 weeks of age. Another way of reducing the protein is to increase the proportion of scratch grain. Orderly and natural growth is desired for the pullets. Any practice of forcing or permitting the premature development during the growing period is likely to result in trouble later—usually undersized birds which lose weight and go into a fall or winter molt.

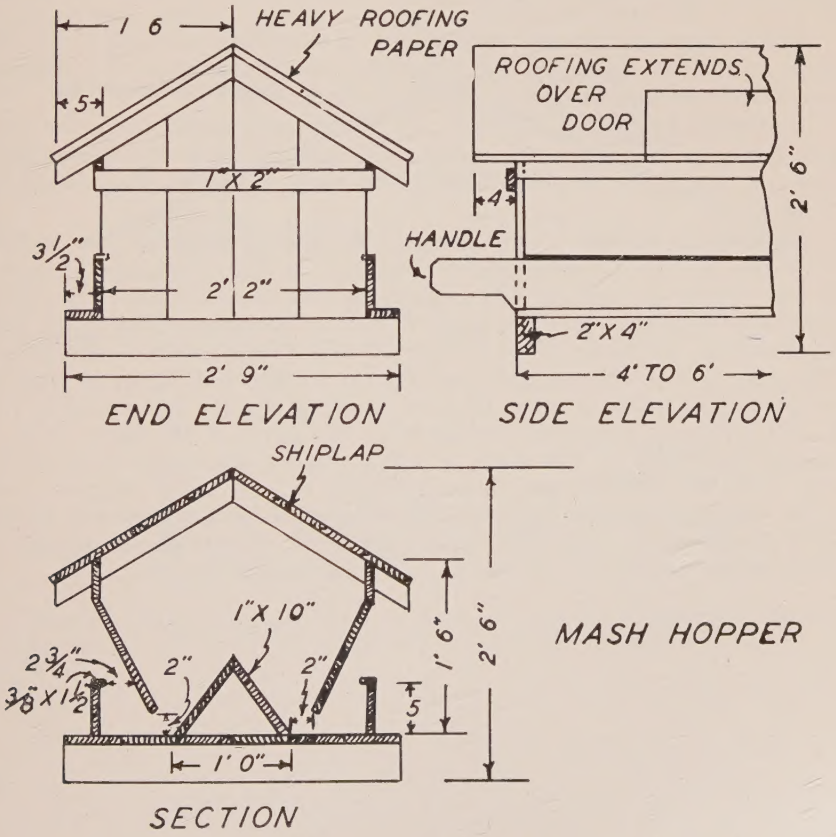


Figure 5.—Range mash hopper equipped with handles to facilitate frequent moving.

Range Management

Move Pullets to the Range Early. The date of hatch and the season will determine the age at which pullets can be moved to the range; in most sections the weather is sufficiently settled by the last of May or the first of June. The type of open air shelter, illustrated in Figure 7, is extensively used for housing pullets while they are out on range. It is designed to accommodate 100 to 125 pullets. Panels covered with 1-inch wire netting may be used as the floor to prevent contact with droppings. If the range house has solid walls, *provide cross ventilation during warm weather.* Leave windows and doors open as illustrated in the front cover picture and provide openings under the rear plate as illustrated in Figures 1 and 6.

Sanitation on the Range. Dry ground provides the greatest security against infestation with intestinal parasites and soil-borne diseases. In irrigated sections a green crop should be well established before the pullets are moved to the range. After the pullets are on the ground water should be kept off the land, particularly around the houses. The range should be as far removed from the laying flock as possible and rotated from year to year, using land that has not had poultry or poultry manure on it for the previous two years.

Move range equipment periodically to encourage the birds to use the range away from the house and to prevent the accumulation of droppings immediately around the house and range equipment.

Soil-borne organisms and flies are chiefly responsible for infestation with intestinal parasites. Inasmuch as the common fly is the intermediate host for tapeworms, any condition which tends to attract flies should be avoided.

Feeding on Range. The feeding and management of the pullets while they are on range ordinarily requires the least time and attention of any period of their development if the rations are correct, range conditions favorable, and the birds free from parasites. The exact feed requirements will need to be judged by the development of the pullet. The mash is kept continuously available in feeders and the grain may be fed in troughs in the evening, or *both the mash and the grain may be fed in self-feeders continuously available to the birds at all times.* It is a normal procedure for the birds to eat a greater percentage of grain as they approach maturity and take on weight. Large range hoppers, such as the one illustrated in Figure 5, and a portable bin on skids are worthwhile conveniences, especially for a large flock. A continuous supply of fresh water is necessarily a part of any good feeding program.

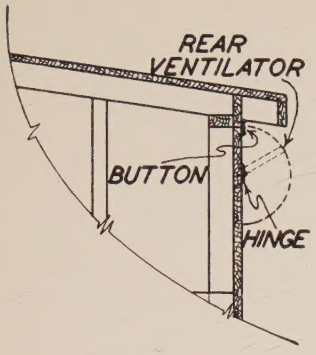


Figure 6.—Suggested opening under plate in rear wall. Use during warm weather to secure cross ventilation.

If the pullets should be infested with intestinal parasites they should be treated while they are still on range, as outlined in Idaho Extension Bulletin, No. 142, *Prevention and Control of Poultry Diseases.*

Move pullets to the laying house as they show the final stage of comb development. This should not be delayed until after they start to lay. It is usually easier to finish the development, especially in the matter of putting on flesh, after the birds have been confined to the laying house. This also provides an opportunity for them to become settled and accustomed to their laying quarters before they come into heavy production. The change from the developing to laying mash should be gradual. To make room for the pullets the old stock should be culled and reduced in late summer. The laying quarters should then be thoroughly cleaned and disinfected.

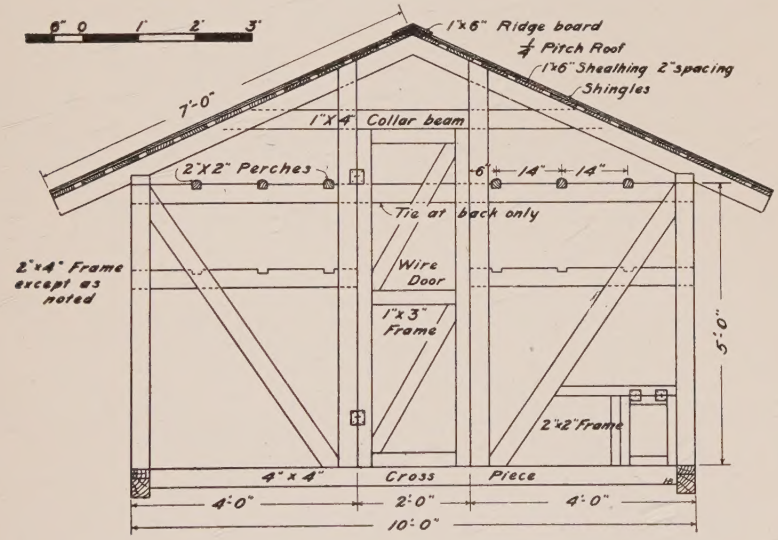


Figure 7.—Open air range shelter on skids. All sides are covered with 1½- or 2-inch mesh wire. Floor panels covered with 1-inch mesh, 18 gauge wire may be used if desired.

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